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Let $a=b=c=\text{etc.}=3$.

$$\therefore\ n=\frac{[5.3]!}{[3!]^5}=\frac{15!}{[3!]^5}.$$

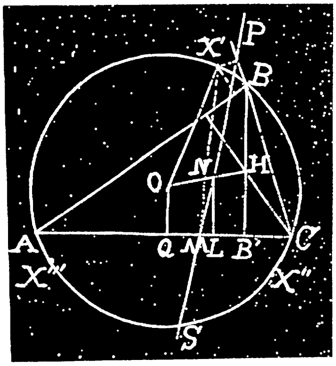
GEOMETRY.

172. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud. Gloucestershire, England.

The center N of the 9-point circle of a triangle ABC lies on P, the pedal line of a point on the circumcircle. Find the angle of intersection of P and AB.

Solution by MARCUS BAKER, Washington. D. C.

In the annexed figure PS is *Simpson's line*, or the pedal line of the circumcircle. Lines drawn from any point X' in the circumcircle perpendicular to the sides of ABC determine three collinear points on Simpson's line. In the figure a point X has been so chosen that the resulting *Simpson line* passes through N, the center of the Twelve Point or Feuerbach circle. H is the orthocenter, O the circumcenter, and N the Feuerbach center. $NO=NH=\frac{1}{2}OH$.



Let $\varphi=$the angle NML to be determined.

$$\tan\varphi=\frac{LN}{LM}=\frac{\frac{1}{2}[OQ+HB']}{\frac{1}{2}QB'-QM}$$

$$=\frac{\frac{1}{2}[R\cos B+2R\cos C\cos A]}{\frac{1}{2}[2R\sin C\cos A-R\sin B]-R\cos\varphi}$$

$$\text{or }\tan\varphi=\frac{\cos C\cos A+\frac{1}{2}\cos B}{\sin C\cos A-\frac{1}{2}\sin B-\cos\varphi}$$

$$=\frac{m}{n-\cos\varphi}\ldots.[1],$$

where $m=\cos C\cos A+\frac{1}{2}\cos B$, $n=\sin C\cos A-\frac{1}{2}\sin B$.

From [1], $n-\dfrac{m}{\tan\varphi}=\cos\varphi$, whence $n^2-\dfrac{2mn}{\tan\varphi}+\dfrac{m^2}{\tan^2\varphi}=\dfrac{1}{1+\tan^2\varphi}$

which reduces to

$$\tan^4\varphi-2\frac{m}{n}\tan^3\varphi+\frac{m^2+n^2-1}{n^2}\tan^2\varphi-2\frac{m}{n}\tan\varphi+\frac{m^2}{n^2}=0\ldots.[2].$$

This equation gives one (or more?) lines filling the conditions. By permuting the letters in [1] two more are similarly found. Points X'' and X''' of the figure determine two more lines fulfilling the conditions.

Also demonstrated by *G. B. M. ZERR*.